

Toys in Space

Standards Statements:

- 3.1.7.A – Explain the parts of a simple system and their relationships to each other.
3.4.7.C – Identify and explain principles of force and motion.

National Standards:

- Understands the law of conservation of energy.
- Understands general concepts related to gravitational force

Content Objectives:

Students will be able to:

1. Explain the role of gravity in the operation of toys.
2. Explain the forces necessary for proper functioning of the toy.
3. Determine if these toys will operate in a microgravity environment.
4. Explain the energy conversions that take place in the functioning of the toys.

Process Objectives:

Students will be able to:

1. Create a hypothesis concerning the functioning of these toys in space.
2. Prepare an oral presentation to demonstrate the role of gravity in the operation of a toy.

Assessment Strategies:

1. Oral presentation explaining the role of forces and gravity in the function of a toy.
2. Written explanation about the operation of the toy in a space environment.
3. Creation of a diagram illustrating the forces acting upon a toy on Earth in comparison to the space environment.

Procedures:

1. Introduce ideas of acceleration, gravity, friction, potential energy, and kinetic energy.
2. Create a word web explaining all of these ideas in relation to Forces and Motion and the affects of these on the function of toys.

Suggested Level:

Intermediate/Secondary

Standard Categories:

- 3.1 – Unifying Themes
3.4 – Physical Science, Chemistry, and Physics

Materials:

Variety of toys affected by gravity such as:

- Yo-yo
- Center of gravity bird
- Air gun with foam darts
- Paddle ball
- Foam balls
- Chinese yo-yo
- Magnetic metal roller

Instructional Strategies:

Cooperative Learning
Inquiry
Discussion

Related Concepts:

Hypothesizing
Observing
Written Communication
Scientific Drawing

Toys in Space

An inquiry activity will be used to investigate the role of gravity in the functioning of toys.

Thought questions to begin:

Will toys work the same in space as they do on earth?

What do you think changes about their behavior in a reduced gravity environment?

What are the reasons for your beliefs?

Investigation:

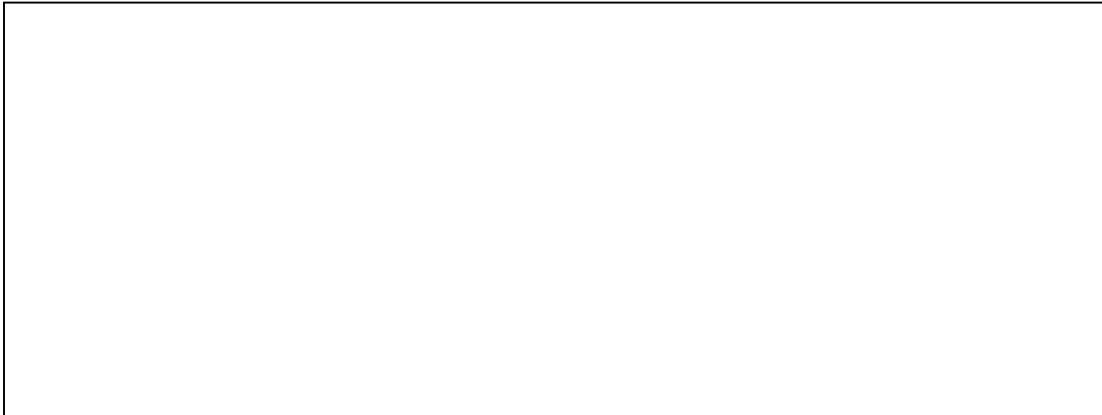
To investigate the role of gravity in the operation of toys, follow the following instructions carefully:

1. Obtain one toy from your instructor.
2. Within your group discuss the various forces acting upon the toy during its operation.
3. Create a diagram in the space labeled Diagram 1. Label and explain the various forces acting upon your toy as it operates on Earth. Write an explanation in the space provided.
4. Hypothesize how your toy would behave in a space environment. Write an explanation in the space provided.
5. Create a diagram in the space labeled Diagram 2. Label and explain the various forces acting upon your toy as it would operate in space.
6. Exchange toys with another group. Repeat steps 2 through 5, creating diagrams for toy #2 in the spaces provided. Explain the functioning of this toy in the spaces provided.
7. Respond to the "Questions to ponder." Prepare an oral presentation explaining the role of forces and gravity in the operation of your toy. Use a diagram to assist you in your presentation.

Questions to ponder:

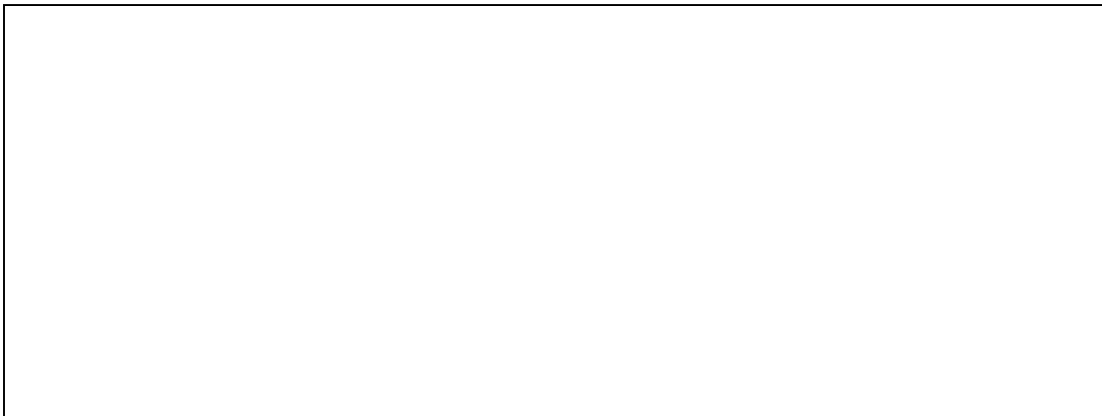
1. What is a force? What forces are most instrumental in the functioning of these toys?
2. What is friction? Explain Sliding Friction, Rolling Friction, and Fluid Friction. What type is most evident in the operation of your toy?
3. How does the acceleration caused by gravity affect the performance of your toy?
4. What determines the strength of the force of gravity?
5. Is their gravitational acceleration present in a space environment? Describe this force as it exists in space? What do you call this type of environment?
6. What is responsible for this gravitational acceleration?
7. Is this attraction more or less than that of Earth's? Why?
8. How would this influence the performance of your toy?
9. Do you think that your toy would work in space? Why or why not?

DIAGRAM 1: Forces acting upon _____ while on Earth



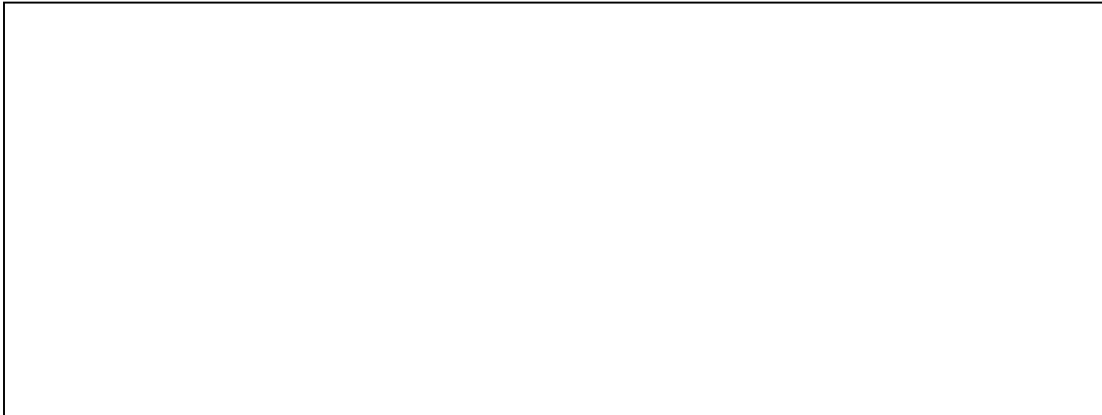
Toy #1: _____ Explanation of the role of gravity in toy operation

DIAGRAM 2: Forces acting upon _____ while in space.



Toy #1: _____ Explanation of operation of toy in microgravity

DIAGRAM 3: Forces acting upon _____ while on Earth



Toy #2: _____ Explanation of the role of gravity in toy operation

DIAGRAM 4: Forces acting upon _____ while in space.



Toy #2: _____ Explanation of operation of toy in microgravity

Scientific Drawing

Name _____ Date _____ Course/Class _____

Task/Assignment _____

Performance Criteria	Assessment			
	Points	Self	Teacher	Other(s)
1. The drawing(s) realistically depicts the object(s).				
2. The drawing includes only those features that were actually observed and not inferred.				
3. Many relevant details are included: size (with metric measurements), colors, textures, shapes, and relationships to surroundings.				
4. Multiple perspectives are drawn to provide the viewer with a complete picture of the structures under study.				
5. A descriptive and accurate title is provided for the drawing(s).				
6. All the parts of the scientific drawing are clearly and accurately labeled.				
7. A detailed, written explanation of what the scientific drawing is intended to show is included.				
8. A key or legend, if needed to explain the drawing(s), is provided.				
9. The scientific drawing(s) is of an appropriate size and scale for details to be easily recognized.				
10. A very precise scale and proportion is used consistently. The scale is stated and uses the metric system when possible.				

Scientific Drawing (continued)

Performance Criteria

11. The principles of artistic composition are well employed in this drawing.

Assessment			
Points	Self	Teacher	Other(s)

O Comments

O Goals

O Actions

Oral Presentation in Science

Name _____ Date _____ Course/Class _____

Task/Assignment _____

Performance Criteria		Assessment			
		Points	Self	Teacher	Other(s)
Content and Organization					
1.	The purpose of the presentation (informing, persuading or both), the subject, and any position taken by the presenter are clearly defined at the outset.				
2.	The presentation is made in an interesting, logical sequence – an introduction, an organized body, and a clear closure – that the audience can follow.				
3.	The introduction has a strong purpose statement that serves to captivate the audience and narrow the topic.				
4.	An abundance of accurate supporting scientific concepts, facts, figures, statistics, scenarios, stories, and analogies are used to support the key points and ideas.				
5.	The vocabulary is appropriate to both the science content and the audience.				
Optional					
6.	Interesting and colorful audiovisuals aids or multimedia materials are interwoven to explain and reinforce the screen text and presentation.				
7.	The topic is developed completely and thoroughly.				

Oral Presentation in Science (continued)

Performance Criteria		Assessment			
		Points	Self	Teacher	Other(s)
Presentation					
8.	The speaker maintains a proper volume, clear elocution, steady rate, effective inflections and enthusiasm throughout the presentation.				
9.	Humor is used positively and in good taste, with consideration given to the composition of the audience.				
10.	Stories and motivational scenarios are used appropriately.				
11.	Body language such as eye contact, posture, gestures, and body movements are appropriate and are used to create effect.				
12.	Delivery is well paced, flows naturally, has good transitions, and is coherent.				
13.	The speaker is relaxed, self-confident and appropriately dressed for purpose or audience.				
Audience					
14.	The audience's attention is maintained by involving them in the presentation.				
15.	Information needed by audience to fully understand the presentation is provided.				
16.	The speaker gives the audience time to think, reflect, and ask questions about points made in the presentation.				
17.	The speaker answers all questions with clear explanations and further elaborations.				

Oral Presentation in Science (continued)

Performance Criteria

18. The topic and the length of the presentation is appropriate for the audience and within the allotted time limits.

Assessment			
Points	Self	Teacher	Other(s)

O Comments	O Goals	O Actions